(2) $y = 2x^2$ $X(-2,0)$; $P(p,0)$

i) Area of a triangle in General:

$$A = \frac{1}{2}\cdot b\cdot h \quad \begin{pmatrix} b = \text{Base} \\ h = \text{Height} \end{pmatrix}$$

Area of XPQ : $A = \frac{1}{2}\cdot(XP)\cdot(PQ)$

$$XP \text{ (distance)} = \sqrt{[p-(-2)]^2 + (0-0)^2} = p+2$$

$$PQ \text{ (distance)} = \sqrt{(x_Q - p)^2 + (y_Q - 0)^2}$$

- Q and P are lined up $\Rightarrow$ $x_Q = p$
- Q lies on the curve $\Rightarrow$ the gradient of Q equals the gradient of the curve

$$\therefore \; y_Q = 2x_Q^2 = 2p^2 \Rightarrow Q(p, 2p^2)$$

$$PQ = \sqrt{(p-p)^2 + (2p^2-0)^2} = \sqrt{(2p^2)^2} = 2p^2$$

$$\text{Area}_{XPQ} = \frac{1}{2}(p+2)(2p^2)$$

$$= \frac{1}{\cancel{2}}\cdot(\cancel{2}p^3 + \cancel{4}^{\,2}p^2)$$

$$\boxed{\text{Area}_{XPQ} = p^3 + 2p^2}$$

ii) $\frac{dA}{dp} = 3p^2 + 4p$; $\frac{dp}{dt} = 0.02$ units ; $\frac{dA}{dt} = ?$ $(p=2)$

$$\frac{dA}{dt} = \frac{dA}{dp} \times \frac{dp}{dt} = \left[3(2)^2 + 4(2)\right] \times 0.02$$

$$= 20 \times 0.02 = 0.4 \text{ Units}$$

$$\boxed{\frac{dA}{dt} = 0.4 \text{ units}}$$